



United States Department of the Interior
U.S. GEOLOGICAL SURVEY
SOUTH CAROLINA WATER SCIENCE CENTER
CLEMSON FIELD OFFICE
405 College Ave., Suite 200
Clemson, South Carolina 29631

July 24, 2012

Mr. Larry E. Turner
Water Quality Modeling Section
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201-1708

Dear Mr. Turner:

At your request, the U.S. Geological Survey (USGS) computed the 7-day, 10-year recurrence-interval flow ($7Q_{10}$) for Station 02161000, Broad River at Alston, SC, using the most recent approved flow data, which goes through climatic year 2011. A climatic year begins on April 1 and ends on March 31 and is designated by the calendar year in which it begins. Consequently, climatic year 2011 began on April 1, 2011, and ended on March 31, 2012. It should be noted that Station 02161000 is influenced to an unknown degree by regulation at low to medium flows and also that no adjustments were made for flow diversions. Low-flow characteristics for regulated sites can be considered valid as long as the observed patterns of regulation and (or) diversions continue to be relatively consistent.

The period of record for daily mean flow (DV) at station 02161000, Broad River at Alston, SC, is from October 1896 to December 1907 and October 1980 to present. In addition, DV data were collected at station 02161500, Broad River at Richtex, SC, from October 1925 through July 1928 and October 1929 through September 1983. Thus, the period from October 1, 1980 through September 30, 1983, is concurrent for the two stations. The drainage area at station 02161000 is 4,790 square miles (mi^2) and the drainage area at station 02161500 is 4,850 mi^2 , a difference of about 1.3 percent. Comparisons of the data for the concurrent period were made and it was concluded that combining the DV data for the purposes of this low-flow analysis was reasonable. Doing so provides a much longer period of record that includes a broad range of hydrologic conditions that might be expected to occur at this site. In addition, provisional assessments indicated that adjusting the daily mean flow data at 02161500 by the drainage-area ratio method to account for the differences in flow that might result from the increase in drainage area between stations 02161000 and 02161500 was reasonable and thus was done for this analysis.

Statistical software was utilized to review the data and do the analyses. The combined daily mean flows from stations 02161000 and 02161500 were used to compute running 7-day average flows. The Kendall Tau statistic and plots of the data by climatic year were used to test for trends in the annual minimum 7-day average flows. The Kendall Tau statistic did indicate a trend in the annual minimum 7-day average flows (fig. 1). The trend is likely due to the historic dry conditions that have occurred over the last decade and not due to changes in the basin. Consequently, the complete period of record was used in the low-flow analysis.

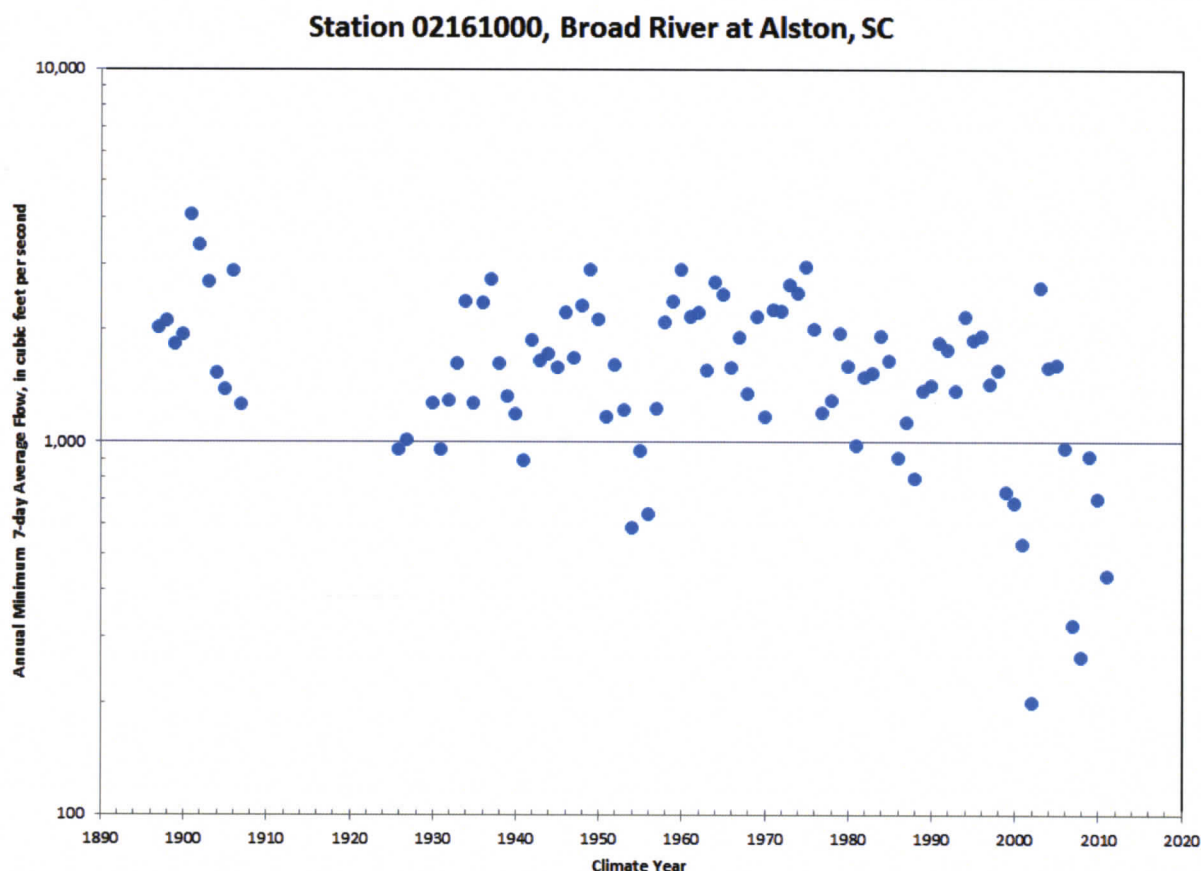


Figure 1. Annual minimum 7-day average flow at station 02161000, Broad River at Alston, SC

Single-mass curves of the 50-percentile 7-day average flows along with the ratio of the 10-percentile to the 50-percentile 7-day average flows also were generated and inspected for long-term changes in flow patterns at the station. The slopes of the single-mass curves were reasonably consistent except for the last decade, which showed a decrease in the slope as would be expected given the low-flow conditions as noted in figure 1. Otherwise, the curves were reasonably consistent for the period of record.

The $7Q_{10}$ estimate was generated by fitting the logarithms of the annual minimum 7-day average flows to a Pearson Type III distribution. As shown on figure 2, the distribution fits the data well throughout most of the range of the data (fig. 2). It can be seen that the lowest 4 data points plot below the curve; however, the curve fit the data well for the 0.1 non-exceedance probability ($7Q_{10}$). The $7Q_{10}$ estimate from this analysis is 720 cubic feet per second.

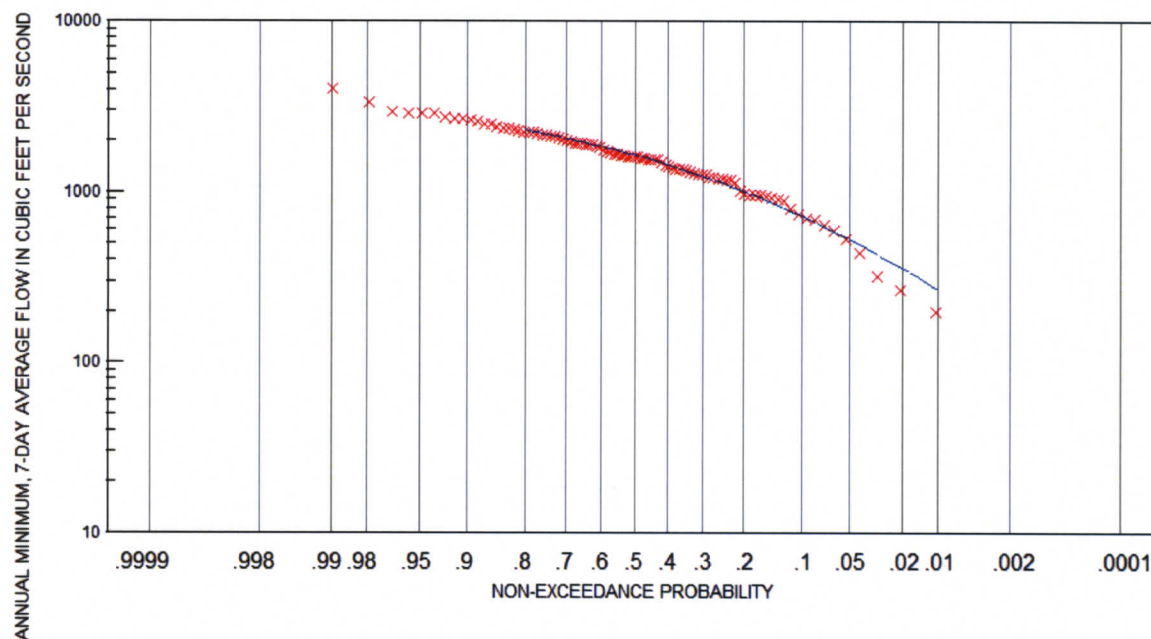


Figure 2. Low-flow frequency curve for the annual minimum 7-day average flows at station 02161000, Broad River at Alston, SC.

If you have any questions concerning this matter, please call me at (864) 656-6747 or Noel Hurley, Jr. at (803) 750-6126.

Sincerely,

Toby D. Feaster
Hydrologist